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(71) Applicant *(for all designated States except US)*: **ANOTO AB** [SE/SE]; c/o C Technologies AB, Scheelevägen 15, S-223 70 Lund (SE).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **ERICSON, Petter** [SE/SE]; Industrigatan 2 B, S-212 14 Malmö (SE).

(74) Agent: **AWAPATENT AB**; Box 5117, S-200 71 Malmö (SE).

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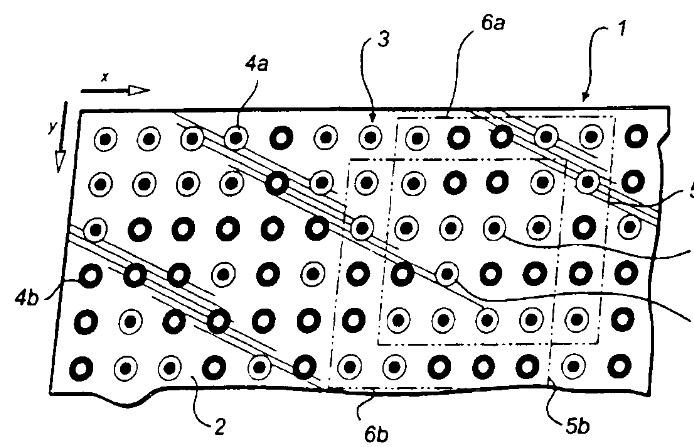

(57) Abstract: In a method of electronic recording of information from an information carrier, a position-coding pattern (3) is placed on top of or under the information carrier. The information on the information carrier and the position-coding pattern (3) are imaged with the aid of a plurality of partial images. The position-coding pattern is used to determine where the partial images should be stored in a memory area. The partial images in the memory area together constitute an image of the information on the information carrier. The position-coding pattern is filtered out of the partial images. A product, a device, and software used for implementing the method are also described.

WO 01/01670 A1

RECORDING OF INFORMATION

Field of the Invention

The present invention relates to a method of electronic recording of information. Furthermore, the invention relates to a product intended to be used in connection with electronic recording of information from an information carrier, which product comprises at least one sheet-shaped portion which is provided with a position-coding pattern. In addition, the invention relates to a computer-readable medium, a system, and a device for recording information.

Background of the Invention

It often happens that a user has text and images in paper form, but would like to convert them to electronic form in order to be able to process them in a computer or to send them electronically, for example in a fax or an e-mail message.

GB 2,288,512 discloses a handheld scanner which can be used for recording images. The scanner comprises a line sensor, two wheels arranged on the ends of the line sensor, and sensors for detecting the rotation of the wheels. The scanner is passed back and forth across an image or a piece of text which the user wishes to record. The relative position of the line sensor is recorded with the aid of the sensors and the wheels. The recorded position is then used to determine where the image data recorded by the line sensor should be stored in an image memory. One drawback associated with the scanner is that it contains moving parts. Another drawback is that the wheels only permit the scanner to be moved in certain directions.

The Applicant's WO98/20446 describes another type of handheld scanner or reading pen which is intended for selective recording of text. It comprises a light-sensitive area sensor, which is adapted to record images with

partially overlapping content. A signal-processing unit utilises the partially overlapping content of the images to put them together into a composite image. OCR software converts the characters in the composite image to character-coded format. This scanner has the advantage that it does not require any moving parts for position determination. However, it is only designed for recording character sequences along one row of text at a time.

US 5,852,434 describes an arrangement for recording handwritten text by determining absolute positions on a writing surface. The arrangement comprises a writing surface provided with a position code, a pen-like device with a pen point and a detector capable of detecting the position code, as well as a computer which is capable of determining the position of the device in relation to the writing surface on the basis of the detected position code. When a user writes on the writing surface the position code is continuously recorded along the path of pen point with the aid of the detector. The recorded position code is transferred to the computer for analysis. Finally, the result is outputted to a display or a printer. However, this arrangement is not suitable for recording existing text or images.

US 5,852,434 describes three examples of a position code. According to one example, the position code is made up of dots, each of which is made up of three concentric circles. The outermost circle represents an X-coordinate and the middle circle represents a Y-coordinate. Furthermore, the two outermost circles are divided into 16 parts, which depending upon whether they are filled in or not indicate different numbers. This means that each pair of coordinates X, Y is coded with a dot with a specific appearance.

Summary of the Invention

It is an object of the present invention to completely or partly obviate the above-mentioned drawbacks

of the prior art devices for electronic recording of text and images.

This object is achieved by a method of recording information according to claim 1, a product intended to be used in connection with electronic recording of information according to claim 12, a computer-readable medium according to claim 23, a device according to claim 27, and a system according to claim 29.

More specifically, according to a first aspect of the invention, it relates to a method of electronic recording of information from an information carrier, which method comprises the steps of placing a sheet with a position-coding pattern and the information carrier such that one superimposes the other; imaging the information on the information carrier and the position-coding pattern with the aid of a plurality of partial images; and using the position-coding pattern for putting together the partial images into a composite image of the imaged information.

According to the invention, a position-coding pattern is thus applied to the information carrier by placing the position-coding pattern on top of or under the information carrier. Accordingly, the information carrier is not provided with a position-coding pattern from the beginning. Instead, the pattern is applied, temporarily or permanently, at a later stage. This means that any image or text can be recorded with the aid of the position-coding pattern.

Since the position-coding pattern is used for putting together the partial images, no special or separate position sensors are required. Moreover, it does not matter in which order or relationship the partial images are recorded because their respective positions are determined by the position-coding pattern. For example, the recordings of the partial images can overlap and the recording can start anywhere on the information carrier. The important thing is that the partial images together

comprise all the information which is to be recorded because this makes it possible to put together the partial images into a composite image with the aid of the position-coding pattern.

Furthermore, the putting-together of the partial images to a composite image can be carried out efficiently with the aid of the position-coding pattern. It requires much less processing capacity than the putting-together of partial images by means of the partially overlapping contents thereof. Moreover, the accuracy and the predictability of the assembly of the partial images are not dependent on the information per se on the information carrier.

The position-coding pattern can be projected as a pattern of light on the information carrier, be copied in a copying machine on to the information carrier or be placed on top of or under the information carrier in any other suitable way.

However, in a preferred embodiment, the step of placing comprises placing a sheet with the position-coding pattern on top of or under the information carrier. This way of placing the position-coding pattern is at the moment the easiest and most inexpensive way of placing the position-coding pattern and the information carrier such that one superimposes the other.

In a preferred embodiment the sheet with the position-coding pattern is furthermore transparent except for the position-coding pattern and is placed on top of the information carrier. This embodiment makes it possible to image both the information on the information carrier and the position-coding pattern simultaneously in every partial image. Then the position-coding pattern can be used for unambiguously determining a position for the part of information imaged in each partial image so that the partial images can be put together without any distortion.

It would, however, also be conceivable to record every second time a partial image of only the information

on the information carrier and every second time a partial image of only the position-coding pattern. In this embodiment the information and the position-coding pattern may be imaged by electromagnetic radiation of different wavelengths and may have different wavelength characteristics. If the sheet with the position-coding pattern is placed on top of the information carrier, the sheet and the position-coding pattern should, in this embodiment, be transparent to the electromagnetic radiation by which the information is imaged, but non-transparent to the electromagnetic radiation by which the position-coding pattern is imaged. If the sheet is placed under the information carrier, the information carrier and the information should, on the other hand, be transparent to the electromagnetic radiation by which the position-coding pattern is imaged, and non-transparent to the electromagnetic radiation by which the information is imaged. Since a device for recording information in this embodiment need to be able to send out electromagnetic radiation of different wavelengths, it will be more complex and thus more expensive. Furthermore, since the position-coding pattern and the information to be recorded are imaged by different partial images, there will be a displacement between the partial image from which a position is determined and the next (or previous) partial image including the information for which the position is used to put together the partial image with other partial images of the information.

In a preferred embodiment, the method according to the invention comprises the further step of filtering out the position-coding pattern. In this way, the final, composite image of the information will essentially constitute an image of the information on the information carrier without the position-coding pattern. The filtering out can be carried out in the composite image or, preferably, in the partial images.

When the position-coding pattern is superimposed on the information on the information carrier it will hide some of the information. In order as far as possible to recreate the original information, the filtering out of the position-coding pattern is preferably effected by replacing pixel values representing the position-coding pattern with pixel values which are obtained by averaging pixel values representing the information. The averaging is preferably carried out on pixels located close to the pixel which is to be replaced. In this context, averaging also comprises averaging with weighting of the pixel values.

The position-coding pattern can be made up of symbols. In that case, the filtering out preferably comprises the steps of, for each symbol, calculating the average of the pixel values of pixels adjacent to the periphery of the symbol and replacing pixel values representing the symbol with said average of the pixel values.

As mentioned above, the position-coding pattern makes it possible to put together the images into a composite image of the information. The putting together of the images preferably comprises the substeps of determining one position for each partial image of the information on the basis of the position-coding pattern in the same or adjacent partial image and determining where the partial image of the information should be stored in a memory area on the basis of the determined position. Since the position obtained from the position-coding pattern represents the location of the same or adjacent partial image on the information carrier it is possible to recreate the information on the information carrier.

In most cases, the partial images will overlap to some degree. This can be used for improving the image: if a pixel in the partial image which is to be stored in the memory area overlaps a pixel in a previously stored image in the memory area, the average of the pixel values of these overlapping pixels is preferably calculated and

the previously stored pixel value is replaced with said average.

In a preferred embodiment the method comprises the steps of imaging the information on the information carrier with a first resolution, if a first part of the position-coding pattern on the sheet is detected, and imaging the information on the information carrier with a second resolution, if a second part of the position-coding pattern is detected.

In this way, a user may to some extent select the speed with which the information on the information carrier is recorded, so that a faster recording can be made when a lower resolution is sufficient.

The different parts of the position-coding pattern may e.g. be parts with different graphical appearances or parts which code co-ordinates from different co-ordinate intervals or areas.

All the steps of the above method with the exception of placing the position-coding pattern on top of or under the information carrier are advantageously carried out "automatically" by a device which records images and which has a processor with software for processing the images as described above.

According to a second aspect of the invention, it relates to a product designed to be used in connection with electronic recording of information from an information carrier, which product comprises at least one sheet-shaped portion provided with a position-coding pattern which extends across the sheet and codes a plurality of positions on the sheet. The sheet-shaped portion is transparent except for the position-coding pattern, the sheet-shaped portion being adapted to be placed on top of the information carrier for recording information from the same.

The product can, for example, consist of the sheet-shaped portion or of a plastic folder, whose front is provided with the position-coding pattern and in which

an information carrier in the form of a sheet of paper with text and images can be placed.

The advantages of the product are evident from the above discussion of the method.

In a preferred embodiment of the invention, each position of said plurality of positions is coded by a specific part of the position-coding pattern and each such part of the position-coding pattern also contributes to the coding of adjacent positions. In the prior art, each position is coded with its own individual code or symbol, which is "isolated" from the codes or symbols of the surrounding positions. The position resolution is thus limited by the partial surface occupied by the symbol(s) or code(s) of a position. However, according to the invention, a specific part of the position-coding pattern is used for coding several positions. In this way, a "floating" transition between positions is obtained, making it possible to increase the position resolution. Furthermore, it is possible to reduce the relationship between, on the one hand, the size of the part of the position-coding pattern which must be read in order to enable position determination and, on the other hand, the size of the specific part of the position-coding pattern which codes a position.

The position-coding pattern can be any arrangement of lines, figures, surfaces or the like which enable unambiguous coding of positions. However, as mentioned above, the position-coding pattern is preferably made up of a plurality of symbols of at least a first type. In the most basic embodiment there are symbols of the first type only and the positions are coded with the aid of the distance between these symbols. Alternatively, the coding can be binary, the existence of a symbol representing a one and the absence of a symbol representing a zero. However, this type of coding can lead to problems in positions which are coded only or primarily with zeros.

In the most preferred embodiment, the position-coding pattern is made up of a plurality of symbols of a first and a second type or appearance only. Such a pattern can be used for binary coding. It is easy to apply to a surface since the symbols can be very simple, for example consisting of two dots of different colours or diameters. The product having a surface with this pattern is thus easy to manufacture since the information content of each symbol is small. Furthermore, it facilitates image processing. Moreover, the symbols are preferably uniformly distributed across the surface, making it particularly easy to create and interpret the pattern.

In order to enable the creation of the pattern from only a few different types of symbols, while still permitting coding of a large number of positions, each position of said plurality of positions is preferably coded with the aid of a plurality of symbols. In this case, it is advantageous for the symbols coding a position to be distributed in two dimensions in such a way that the same position resolution can be achieved in two perpendicular directions on the surface.

Each of the symbols preferably contributes to the coding of more than one of said plurality of positions. However, there may be edge effects preventing this from being fulfilled in the case of a very few symbols.

The position-coding pattern is optically readable so that both the position-coding pattern and the information can be recorded with the same sensor. The pattern should thus be capable of reflecting, emitting or absorbing light. However, the light need not be in the visible range. The pattern may also be fluorescent, the fluorescence being activated by electromagnetic radiation from the device which is used for recording information from the information carrier.

The symbols in the pattern can be of any suitable type. They are preferably graphic so that it will not be necessary to carry out character recognition (OCR)

in connection with the position determination, but they could also consist of numbers or characters.

Furthermore, the symbols are substantially regular in shape, preferably rotationally symmetrical, so that the symbols can be identified in the partial images essentially independently of the rotation of the image. They can, for example, be squares, polygons, lines or, preferably, circular.

Moreover, the symbols are suitably composed of two colours with a contrasting effect, such as black and white or red and green.

A symbol having an inner circle filled with a first colour and an outer circle filled with a second colour up to the edge of the inner circle is especially preferred. In that way, the symbol can be identified with the aid of the circular borderline between the first and the second colour. This identification is reliable since it cannot be distorted by the information on the information carrier on which the position-coding pattern has been superimposed.

The above-described pattern of symbols need not necessarily be placed on a transparent sheet. It may also very well be used on a non-transparent sheet when partial images are alternatively recorded of the position-coding pattern and of the information on the information carrier.

The position-coding pattern can be made up at random so that it does not in itself contain any information about the positions it codes, but rather the part of the position-coding pattern which is located on a partial surface must be matched with the position-coding pattern of the entire surface to enable the determination of the position of the partial surface. However, this has the drawback that the position determination requires a great deal of processor capacity. In addition, it is difficult to generate a position-coding pattern without ambiguities

at random, unless one accepts a considerable amount of redundancy.

Alternatively, each of said plurality of positions can be defined by a first and a second coordinate which can be determined by means of the part of the position-coding pattern which is located on the associated partial surface, the position-coding pattern representing the address of the location where the first and second coordinates are stored. However, a position-coding pattern made up in this way requires a great deal of memory space.

Accordingly, in a preferred embodiment, the position-coding pattern is structured in such a way that the position-coding pattern coding a certain position contains inherent information about that position.

More specifically, the position-coding pattern is preferably based on a first string of symbols, which contains a first predetermined number of symbols and which has the characteristic that if a second predetermined, preferably successive, number of symbols are taken from the first string of symbols, the location of these symbols in the first string of symbols is unambiguously determined, the first string of symbols being used for determining the position of the partial image in a first dimension on the information carrier. Since the position code is based on a string of symbols with a finite number of symbols arranged in a predetermined order, it is possible to define a "formula" for determining the position in a first dimension on the surface. In this way, only a small amount of memory space is required for storing the string of symbols and the position determination can be carried out quickly and easily. The position in the first dimension can, for example, be indicated as a coordinate in a Cartesian or a polar coordinate system.

As mentioned above, several of the steps of the method according to the invention are carried out with the aid of a suitably programmed processor. According to

a third aspect, the invention thus relates to a computer-readable medium which stores a computer program for recording information, which computer program comprises instructions for processing a plurality of partial images which together comprise the information to be recorded and a position-coding pattern, the processing comprising the step of using the position-coding pattern for putting the partial images of the information together into a composite image of the information.

The computer program can be designed to be used in the device which records the information or in another device to which the images are transferred for processing.

The computer-readable medium with the computer program has essentially the same advantages as the above method.

According to a fourth aspect, the invention relates to a device for recording information, comprising a sensor for recording partial images of an information carrier and a position-coding pattern; image-processing means for processing the partial images recorded by the sensor, which image-processing means are adapted to use the position-coding pattern in the partial images to determine where each partial image should be stored in a memory area.

According to a fifth aspect, the invention relates to a system comprising a product and a device of the type described above. The device and the system have essentially the same advantages as the product and the method. Features described above with respect to the method and the product may also be found in the device and the system.

The invention can be used for recording information from any type of information carrier on top of which or under which a position-coding pattern can be placed so that both the information on the information carrier and

the position-coding pattern can be recorded either simultaneously or in an alternating manner.

Brief Description of the Drawings

The present invention will be described in more detail below by way of a presently preferred embodiment with reference to the accompanying drawings, in which

Fig. 1 is a schematic illustration of an example of a product having a sheet-shaped portion with a position-coding pattern;

Fig. 2 is a schematic illustration of an example of how the symbols can be designed in one embodiment of the position-coding pattern;

Fig. 3 is a schematic view of an example of 4x4 symbols that are used to code a position;

Fig. 4 is a schematic illustration of an embodiment of a device according to the invention;

Fig. 5 is a schematic illustration of an example of the order in which partial images can be recorded from an information carrier;

Fig. 6 is a flowchart showing how partial images are processed;

Fig. 7 is a schematic illustration of a sheet with a position-coding pattern according to a further embodiment of the invention; and

Fig. 8 is a schematic illustration of a second embodiment of the device.

Description of Preferred Embodiments

The Product

Fig. 1 shows a part of a transparent sheet 1 having a surface 2 on which an optically readable position-coding pattern 3 has been applied. The sheet 1 can be a part of a product, for example a plastic folder, but in this case the sheet constitutes the entire product. The position-coding pattern 3 is made up of symbols 4 of a first and second type 4a, 4b and more specifically of dots of two different appearances, the dots 4a having a black centre dot with a white ring around it representing

a one and the dots 4b having a white centre dot with a black ring around it representing a zero. For the sake of clarity, the dots have been enlarged. They are equal in size and they are equidistant.

The position-coding pattern is arranged so that if a device images the dots on a partial surface of a predetermined size, the position of the partial surface on the surface of the sheet can be determined automatically with the aid of image-processing means in the device. Dashed lines indicate a first and a second partial surface 5a and 5b respectively. The part of the position-coding pattern which is located on the first partial surface 5a constitutes a first specific part 6a of the position-coding pattern. This first specific part codes a first position 7a, which coincides with the middle symbol on the partial surface. Correspondingly, a second position 7b is coded by the specific part 6b of the position-coding pattern located on the second partial surface 5b. The position-coding pattern is thus partially shared by the adjoining positions 7a and 7b.

Position-coding pattern - Example 1

A first example of a position-coding pattern enabling position determination will be described below. The pattern is adapted for position determination by the imaging of a partial surface containing 5 x 5 symbols. As mentioned above, the symbols represent a binary coding.

The sheet has an x-direction and a y-direction. In order to code the position in the x-direction, a 32-bit number series of ones and zeros is generated in a first step. In a second step, a 31-bit number series of ones and zeros is generated by removing the final bit of the 32-bit series. Both number series, hereinafter called the x-number series, should have the characteristic that if five successive numbers are selected anywhere in the series a unique group of five bits is obtained which does not exist anywhere else in the series. They should also have this characteristic if one "connects" the end of the

series to the beginning of the series. The five-bit group thus provides an unambiguous coding of the location in the series.

An example of a 32-bit number series having the above characteristic is "00001000110010100111010110111110". If the last zero is removed from this number series, a 31-bit number series having the same characteristic is obtained.

The first five bits in the above number series, i.e. 00001, constitute the code for position 0 in the number series, the next five bits, i.e. 00010, constitute the code for position 1, etc. The positions in the x-number series as a function of the five-bit groups are stored in a first table. Naturally, position 31 only exists in the 32-bit series. Table 1 below shows the position coding for the example described above.

Table 1:

Position	Five-bit Group
0	00001
1	00010
2	00100
3	01000
4	10001
5	00011
6	00110
7	01100
8	11001
9	10010
10	00101
11	01010
12	10100
13	01001
14	10011
15	00111
16	01110

Position	Five-bit Group
17	11101
18	11010
19	10101
20	01011
21	10110
22	01101
23	11011
24	10111
25	01111
26	11111
27	11110
28	11100
29	11000
30	10000
31	00000

It is only possible to code 32 positions, i.e. positions 0-31, with the aid of the 32-bit series. However, if one writes the 31-bit series 32 times in succession on a first row and the 32-bit series 31 times in succession on a second row below the first row, the series will be displaced in relation to each other in such a way that two five-bit groups written one above the other can be used to code 31 x 32 = 992 positions in the direction of the rows.

For example, suppose that the following code is written on the sheet:

000...1111100000100011001010011101011011110...

000...111110000100011001010011101011011111100...

If the five-bit groups are translated into positions according to Table 1, the following positions of the 32- and 31-bit series are indicated on the sheet.

0 1 2 ...30 31 0 1 2...29 30 31 0 1 2

0 1 2 ...30 0 1 2 3...30 0 1 2 3 4

The coding in the X-direction is thus based on using a number series consisting of n bits which is made up in such a way that if m successive numbers are taken from

the series, these m numbers will code the position in the series unambiguously. The number of codable positions is increased by using a second number series, which is a subset of the first number series and which is thus of a different length than first series. In this way, a displacement between the series is obtained in the longitudinal direction of the rows.

The coding in the Y-direction is based on the same principle. A number series is created, hereinafter called the Y-number series, which consists of p numbers, the series being made up in such a way that if r successive numbers are taken from the series, these r numbers will code the position in the series and thus the position in the Y-direction unambiguously. The numbers in the Y-number series are coded in the pattern on the sheet as a difference between the positions in the X-direction in two rows, which is calculated in a special way.

More specifically, alternate rows of the 31-bit series and the 32-bit series are written as follows:

Row 1: (31) (31) (31) (31)..
Row 2: (32) (32) (32) (32)..
Row 3: (31) (31) (31) (31)..
Row 4: (32) (32) (32) (32)..
Row 5: (31) (31) (31) (31)..
.
.

Naturally, on the sheet, the series are written using the two different sizes of dots. The rows start in different positions in the X-number series. More specifically, one begins two successive rows in such a way that if one determines the difference modulo 32 between two position numbers located one above the other, expresses the difference by means of a five-bit binary number, and takes the two most significant bits of said five-bit binary number, this number shall be the same regardless of where one is in the row. In other words, one starts the series in such a way that the displacements between

the series in two successive rows remain within a specific interval along the entire row. In this example, the maximum displacement is 31 positions or bits and the minimum displacement is 0 positions or 0 bits. The displacements along each pair of rows is then within one of the intervals 0-7, 8-15, 16-23, or 24-31 positions/bits.

For example, suppose that the series are written as follows (expressed as position numbers):

Row 1:	0	1	2	3	4	5	6	7....30	0	1	2	3
Row 2:	0	1	2	3	4	5	6	7....30 31	0	1	2	
Row 3:	25	26	27	28	29	30	0	1....24	25	26	27	28
Row 4:	17	18	19	20	21	22	23	24....16	17	18	19	20
Row 5:	24	25	26	27	28	29	30	0....23	24	25	26	27

If the difference is determined in the above way, it will be 0 between rows 1 and 2, 0 between rows 2 and 3, 1 between rows 3 and 4, and 3 between rows 4 and 5. Take, for example, 26-18 in rows 3 and 4, which equals 8, which is 01000 in binary code. The two most significant numbers are 01. If instead one takes 0 - 23 in the same rows, which modulo 32 equals 9, the two most significant numbers are 01 just like in the previous example. In this example, four difference numbers 0,0,1,3 are obtained. Now, if in same way as for the X-direction, one has created a Y-number series from the numbers 0, 1, 2, and 3 which has the characteristic that if four successive numbers are taken from the series, the position in the series will be determined unambiguously, it is possible by looking up the number 0013 in a table to unambiguously determine the position in the Y-direction. In this way, it is possible to determine 256 unique positions in the Y-direction.

The following is an example of the beginning and the end of a Y-number series containing the numbers 0-3:

Table 2:

0	0000
1	0001
2	0010
3	0100
4	1000
5	0002
6	0020
7	0200
8	2000
9	0003
10	0030
.	.
.	.
251	2333
252	3333
253	3330
254	3300
255	3000

The following is a description of how the position determination is carried out. Suppose that one has a sheet as described above which across its surface has a pattern made up of a first symbol representing a one and a second symbol representing a 0. The symbols are arranged in rows and columns and in 32-bit and 31-bit series as described above. Furthermore, suppose that one wishes to determine the position on the sheet where one places a device equipped with a sensor which can record an image containing 5 x 5 symbols.

Suppose that the image recorded by the sensor looks as follows:

```
1 1 1 1 1
1 1 1 1 1
0 1 0 1 0
0 0 1 0 1
0 0 1 0 1
```

In a first step, the device translates these five-bit groups into positions with the aid of Table 1. The following positions are obtained:

26 (11010)
26 (11010)
11 (01011)
10 (01010)
05 (00101)

Subsequently, the magnitude of the displacement between the position numbers in the different rows is determined by taking the difference modulo 32. The two most significant numbers of the differences determined in this manner expressed as five-bit binary numbers are 0, 1, 0, 0. According to Table 2, this difference number equals position 3 in the Y-direction. Thus, the coordinate of the second dimension on the sheet is 3.

A third table stores the starting position of each row, i.e. the position in the X-numbers series where each row starts. In this case, with the aid of the y-coordinate 3, it is possible to look up the starting positions of the rows from which the recorded five-bit groups have been taken. Knowing the starting positions of the rows from which the two uppermost five-bit groups have been taken and the X-positions to which these two five-bit groups correspond, i.e. positions 26 and 26, it is possible to determine the x-coordinate, or the position in the first dimension, of the recorded image. For example, suppose that the starting positions of the two uppermost rows are 21 and 20 respectively. In this case, the two rows from which the two uppermost five-bit groups in the recorded image are taken will thus look as follows:

Row 3: 21 22 23....29 30 31 0 1 2...25 26 27..
Row 4: 20 21 22....28 29 30 0 1 2...25 26 27..

It follows from the fact that the y-coordinate is 3 that the two first five-bit groups are taken from rows 3 and 4. It follows from the fact that odd rows are made up of the 32-bit number series and even rows are made up

of the 31-bit number series that row 3 is made up of a 32-bit number series while row 4 is made up of a 31-bit number series.

On the basis of this information, it is possible to determine that the x-coordinate is 35. This can be verified by repeating the above steps for the remaining pairs of five-bit groups in the recorded image. There is thus a certain amount of error tolerance.

The accuracy of the position determination can be further increased by determining the location of the middle dot in the 5 x 5 group in relation to the centre of the image. The position resolution can thus be better than the distance between two symbols.

Naturally, the above steps are carried out by software, which in this example gives the coordinates 3 and 35 as its output signal.

The position-coding pattern can also be used for determining the position in a third dimension in relation to the surface, i.e. in the Z-direction. This is achieved by determining the size of the symbols in the recorded image and comparing it to a reference value representing the size of the symbols when they are imaged by means of an information-recording device which is held next to the surface on which the position-coding pattern is located. In this way, the device can thus automatically determine whether the device is close to the surface, in which case images shall be recorded, or spaced from the surface, in which case images shall not be recorded, and trigger image recording depending on this.

The above description relates to an example and can thus be generalised. There need not be 32 numbers in the first X-number series. The number depends on how many different symbols are to be used in the pattern in combination with the number of symbols which are recorded in the X-direction in connection with the position determination. For example, if the number of different symbols is 3 and the number of recorded symbols is 3, the maximum

number of numbers in the X-number series will be 3x3x3=27 instead of 32. The same type of reasoning applies to the Y-number series. The bases of these number series can thus be different and the number of symbols which code a position, and consequently also the number of positions coded by the number series, can vary. Moreover, the series can be based on symbols other than numbers and can therefore be described as strings of symbols.

As mentioned above, the symbols can be of many different kinds. They can also be numbers, but in that case OCR software is required for carrying out the position determination, which makes the device for image recording more expensive and more complicated. It also leads to increased error sensitivity.

The above method of coding positions on a surface and of carrying out the position determination on the surface is advantageous in that it only requires a very small amount of memory and processor capacity. In the above example, it is only necessary to store Table 1 with 32 rows, Table 2 with 256 rows, and Table 3 with 256 rows. The position determination can be carried out by means of three table look-ups and a simple calculation.

Furthermore, the method of coding positions on the surface is also advantageous because the image upon which the position determination is based can be captured at any rotation in relation to the surface upon which the position is to be determined. In the first place, an image contains a number of rows which shall be horizontal. This means that there are only four possible orientations. In 98% of cases, only one of the four orientations gives a position. In the cases where there is doubt, it can be removed by recording two adjacent images and determining the positions on the basis of these images at all possible orientations of the symbols in the images, the criterion being that the position determination shall result in two adjacent positions.

On the basis of the above-mentioned code, position determination can also be carried out in ways other than those described above.

The recorded image of a partial surface of the position-coding pattern can be matched with an image of the whole position-coding pattern. However, this requires a great deal of processor capacity.

Alternatively, the symbols in the image can be translated into an address in a table in which the coordinates are stored. However, this requires a great deal of memory capacity.

Position-coding pattern - example 2

Below a second example of a position-coding pattern is described. It has substantially the same properties as the above-described pattern.

This second position-coding pattern comprises a virtual raster, which thus neither is visible to the human eye nor can be detected directly by a device which is to determine positions on the surface, and a plurality of symbols 104, which each are capable of assuming one of four values "1"-"4" as will be described below.

Figs 2a-d show an embodiment of a symbol which can be used in the position-coding pattern according to the invention. The symbol comprises a virtual raster point 106 which is represented by the intersection between the raster lines, and a marking 107 which has the form of a dot. The value of the symbol depends on where the marking is located. In the example in Fig. 2, there are four possible positions, one on each of the raster lines extending from the raster points. The displacement from the raster point is equal to all values. In the following, the symbol in Fig. 2a has the value 1, in Fig. 2b the value 2, in Fig. 2c the value 3 and in Fig. 2d the value 4. Expressed in other words, there are four different types of symbols.

Each symbol can thus represent four values "1-4". This means that the position-coding pattern can be divid-

ed into a first position code for the x-coordinate, and a second position code for the y-coordinate. The division is effected as follows:

Symbol value	x-code	y-code
1	1	1
2	0	1
3	1	0
4	0	0

Thus, the value of each symbol is translated into a first digit, in this case bit, for the x-code and a second digit, in this case bit, for the y-code. In this manner, two completely independent bit patterns are obtained. The patterns can be combined to a common pattern, which is coded graphically by means of a plurality of symbols according to Fig. 2.

Each position is coded by means of a plurality of symbols. In this example, use is made of 4x4 symbols to code a position in two dimensions, i.e. an x-coordinate and a y-coordinate.

The position code is made up by means of a number series of ones and zeros which have the characteristic that no sequence of four bits appears more than once in the series. The number series is cyclic, which means that the characteristic also applies when one connects the end of the series to the beginning of the series. Thus a four-bit sequence always has an unambiguously determined position in the number series.

The series can maximally be 16 bits long if it is to have the above-described characteristic for sequences of four bits. In this example, use is, however, made of a series having a length of seven bits only as follows:

"0 0 0 1 0 1 0".

This series contains seven unique sequences of four bits which code a position in the series as follows:

Position in the series	Sequence
0	0001
1	0010
2	0101
3	1010
4	0100
5	1000
6	0000

For coding the x-coordinate, the number series is written sequentially in columns across the entire surface that is to be coded. The coding is based on the difference or position displacement between numbers in adjoining columns. The size of the difference is determined by the position (i.e. with which sequence) in the number series, in which one lets the column begin. More specifically, if one takes the difference modulo seven between on the one hand a number which is coded by a four-bit sequence in a first column and which thus can have the value (position) 0-6, and, on the other hand, a corresponding number (i.e. the sequence on the same "level") in an adjoining column, the result will be the same independently of where along the two columns one makes the comparison. By means of the difference between two columns, it is thus possible to code an x-coordinate which is constant for all y-coordinates.

Since each position on the surface is coded with 4x4 symbols in this example, three differences (having the value 0-6) as stated above are available to code the

x-coordinate. Then the coding is carried out in such manner that of the three differences, one will always have the value 1 or 2 and the other two will have values in the range 3-6. Consequently no differences are allowed to be zero in the x-code. In other words, the x-code is structured so that the differences will be as follows: (3-6) (3-6) (1-2) (3-6) (3-6) (1-2) (3-6) (3-6) (1-2)... Each x-coordinate thus is coded with two numbers between 3 and 6 and a subsequent number which is 1 or 2. If three is subtracted from the high numbers and one from the low, a number in mixed base will be obtained, which directly yields a position in the x-direction, from which the x-coordinate can then be determined directly, as shown in the example below.

By means of the above described principle, it is thus possible to code x-coordinates 0,1,2..., with the aid of numbers representing three differences. These differences are coded with a bit pattern which is based on the number series above. The bit pattern can finally be coded graphically by means of the symbols in Fig. 2.

In many cases, when reading 4x4 symbols, it will not be possible to produce a complete number which codes the x-coordinate, but parts of two numbers. Since the least significant part of the numbers is always 1 or 2, a complete number, however, can easily be reconstructed.

The y-coordinates are coded according to the same principle as used for the x-coordinates. The cyclic number series is repeatedly written in horizontal rows across the surface which is to be position-coded. Just like in the case of the x-coordinates, the rows are allowed to begin in different positions, i.e. with different sequences, in the number series. However, for y-coordinates one does not use differences but codes the coordinates with numbers that are based on the starting position of the number series on each row. When the x-coordinate for 4x4 symbols has been determined, it is in fact possible to determine the starting positions in

number series for the rows that are included in the y-code in the 4x4 symbols. In the y-code the most significant digit is determined by letting this be the only one that has a value in a specific range. In this example, one lets one row of four begin in the position 0-1 in the number series to indicate that this row relates to the least significant digit in a y-coordinate, and the other three begin in the position 2-6. In y-direction, there is thus a series of numbers as follows: (2-6) (2-6) (2-6) (0-1) (2-6) (2-6) (2-6) (0-1) (2-6)... Each y-coordinate thus is coded with three numbers between 2 and 6 and a subsequent number between 0 and 1.

If 1 is subtracted from the low number and 2 from the high, one obtains in the same manner as for the x-direction a position in the y-direction in mixed base from which it is possible to directly determine the y-coordinate.

With the above method it is possible to code 4 x 4 x 2 = 32 positions in x-direction. Each such position corresponds to three differences, which gives 3 x 32 = 96 positions. Moreover, it is possible to code 5 x 5 x 5 x 2 = 250 positions in y-direction. Each such position corresponds to 4 rows, which gives 4 x 250 = 1000 positions. Altogether it is thus possible to code 96000 positions. Since the x-coding is based on differences, it is, however, possible to select in which position the first number series begins. If one takes into consideration that this first number series can begin in seven different positions, it is possible to code 7 x 96000 = 672000 positions. The starting position of the first number series in the first column can be calculated when the x-coordinate has been determined. The above-mentioned seven different starting positions for the first series may code different sheets of paper or writing surfaces on a product.

With a view to further illustrating the position-coding pattern according to this embodiment, here follows

a specific example which is based on the described embodiment of the position code.

Fig. 3 shows an example of an image with 4x4 symbols which are read by a device for position determination.

These 4x4 symbols have the following values:

4 4 4 2

3 2 3 4

4 4 2 4

1 3 2 4

These values represent the following binary x- and y-code:

<u>x-code</u>:	<u>y-code</u>:
0 0 0 0	0 0 0 1
1 0 1 0	0 1 0 0
0 0 0 0	0 0 1 0
1 1 0 0	1 0 1 0

The vertical x-sequences code the following positions in the number series: 2 0 4 6. The differences between the columns will be -2 4 2, which modulo 7 gives: 5 4 2, which in mixed base codes position (5-3) x 8 + (4-3) x 2 + (2-1) = 16 + 2 +1 = 19. Since the first coded x-position is position 0, the difference which is in the range 1-2 and which is to be seen in the 4x4 symbols is the twentieth such difference. Since furthermore there are a total of three columns for each such difference and there is a starting column, the vertical sequence furthest to the right in the 4x4 x-code belongs to the 61st column in the x-code (3 x 20 + 1 = 61) and the one furthest to the left belongs to the 58th.

The horizontal y-sequences code the positions 0 4 1 3 in the number series. Since these series begin in the 58th column, the starting position of the rows are these numbers minus 57 modulo7, which yields the starting positions 6 3 0 2. Translated into digits in the mixed base, this will be 6-2, 3-2, 0-0, 2-2 = 4 1 0 0 where the third digit is the least significant digit in the number at issue. The fourth digit is then the most significant

digit in the next number. In this case, it must be the same as in the number at issue. (An exceptional case is when the number at issue consists of the highest possible digits in all positions. Then one knows that the beginning of the next number is one greater than the beginning of the number at issue.)

The position of the four-digit number will then in the mixed base be 0x50 + 4x10 + 1x2 + 0x1 = 42.

The third row in the y-code thus is the 43rd which has the starting position 0 or 1, and since there are four rows in all on each such row, the third row is number 43x4=172.

Thus, in this example, the position of the uppermost left corner for the 4x4 symbol group is (58,170).

Since the x-sequences in the 4x4 group begin on row 170, the x-columns of the entire pattern begin in the positions of the number series ((2 0 4 6) - 169) modulo 7 = 1 6 3 5. Between the last starting position (5) and the first starting position, the numbers 0-19 are coded in the mixed base, and by adding up the representations of the numbers 0-19 in the mixed base, one obtains the total difference between these columns. A naive algorithm to do so is to generate these twenty numbers and directly add up their digits. The resulting sum is called s. The sheet of paper or writing surface will then be given by (5-s)modulo7.

In the example above, an embodiment has been described, in which each position is coded with 4 x 4 symbols and a number series with 7 bits is used. Of course, this is but an example. Positions can be coded with a larger or smaller number of symbols. The number of symbols need not be the same in both directions. The number series can be of different length and need not be binary, but may be based on another base. Different number series can be used for coding in x-direction and coding in y-direction. The symbols can have different numbers of values.

In the example above, the marking is a dot but may, of course, have a different appearance. For example, it may consist of a dash which begins in the virtual raster point and extends therefrom to a predetermined position. Preferably, it may consist of the above-described dot with an inner circle filled with a first colour and an outer circle filled with a second contrasting colour up to the edge of the inner circle.

In the example above, the symbols within a square partial surface are used for coding a position. The partial surface may have a different form, such as hexagonal. The symbols need not be arranged in rows and columns at an angle of 90° to each other but can also be arranged in some other manner.

For the position code to be detected, the virtual raster must be determined. This can be carried out by studying the distance between different markings. The shortest distance between two markings must derive from two neighboring symbols having the value 1 and 3 so that the markings are located on the same raster line between two raster points. When such a pair of markings has been detected, the associated raster points can be determined with knowledge of the distance between the raster points and the displacement of the markings from the raster points. When two raster points have once been located, additional raster points can be determined by means of measured distances to other markings and with knowledge of the relative distance of the raster points.

In a real implementation of the second position-coding pattern a nominal spacing of 0.3 mm between the raster lines has been used. If each position is coded by 6 x 6 symbols, an area of 1.8 mm x 1.8 mm is required for each position. By determining the position of the 6 x 6 symbols on a sensor of a recording device which is used for recording information, a position can be calculated with a resolution of 0.03 mm.

Device for Recording Information

An embodiment of a device for recording information is schematically shown in Fig. 4. It comprises a casing 11 having approximately the same shape as a pen. In one short side of the casing there is an opening 12. The short side is intended to abut against or be placed a short distance from the information carrier from which information is to be recorded.

The casing essentially contains an optics part, an electronic circuitry part, and a power supply.

The optics part comprises at least one light-emitting diode (LED) 13 for illuminating the surface which is to be imaged and a light-sensitive area sensor 14, such as a CCD or CMOS sensor, for recording a two-dimensional image, in colour, black and white, or greyscale. The device may also comprise an optical system such as a mirror system or a lens system. It should be noted that the sensor 14 should be designed in such a way that it can capture an image of the information carrier and the superimposed position-coding pattern at the same time. The light-emitting diode may be a IR-diode emitting light of about 880 nm.

The power supply to the device is obtained from a battery 15, which is mounted in a separate compartment in the casing.

The electronic circuitry part comprises image-processing means 16 comprising a processor unit with a processor which is programmed to read a partial image from the sensor, identify the position-coding pattern in the partial image, determine a position on the basis of the identified position-coding pattern, and store the partial image in a location in a memory forming part of the image-processing means which is indicated by the position determined from the position-coding pattern.

Moreover, the device comprises buttons 18 by means of which the user activates and controls the device. It also comprises a transceiver 19 for wireless transfer,

e.g. using IR light or radio waves, of information to and from the device. The device can also comprise a display 20 for showing recorded information.

The Applicant's Swedish patent No. 9604008-4 describes a device for recording text. This device can be utilised for recording information using the method according to the invention if programmed in a suitable way.

As mentioned above, the device can be divided into different physical casings, a first casing containing components required for capturing images of information carrier with the superimposed position-coding pattern and for transferring them to components which are located in a second casing and which carry out the position determination and the storing of the images in the memory.

Operation

Suppose that a user has an information carrier in the form of a sheet of paper with text and an image which he wishes to send in an e-mail message to another person. In this case, he places the above-mentioned transparent sheet 1 with the first position-coding pattern 3 (example 1) on top of the sheet of paper. Subsequently, he turns on the above-mentioned device for recording information, places the device so that the opening 12 abuts against the information carrier and passes the device back and forth across the area on the information carrier containing the text and the image which he wishes to record. It is important for the user to "scan" the whole area which is of interest to him so that the partial images recorded by the device together cover the whole area. However, as will be seen below, it does not matter if several partial images cover the same area.

Fig. 5 schematically shows an example of how partial images can be recorded from an information carrier. For the sake of clarity, the position-coding pattern is not shown. The information on the information carrier is shown as a sun and a cloud in broken lines. Partial

images 30-33 are recorded in such a way that they overlap using a left-to-right motion. Subsequently, the user lifts the device and puts it down slightly to the right of partial image 33, after which partial images 34-39 are recorded using a back-and-forth motion. The user continues to pass the device across the information carrier until the whole area that he wishes to record has been scanned. During the scanning, the device records images at a predetermined frequency, the LED 13 generating strobe pulses at the same frequency, e.g. 100 Hz.

When the sensor has recorded a partial image it is read by the image-processing means 16 and is processed immediately or subsequent to buffering in the memory. The partial images are preferably recorded at a frequency such that they partially overlap, making it easier to scan the area from which information is to be recorded.

Each recorded image is processed as follows by the software in the device, see the flowchart in Fig. 6.

First, a partial image is fetched, step 40. This image is scanned, step 41, in a first pass where the processor searches for symbols 4a having a black centre dot with a white ring around it. When it has found the first such dot the searching becomes simpler because it knows the distance between the dots in the position-coding pattern.

Subsequently, the partial image is scanned again, step 42, in a second pass where the processor searches for symbols having a white centre dot with a black ring around it. An identified position of a black dot can be used as a starting-point for this search, the processor again utilising the known distance between the dots.

When the part of the position-coding pattern which is located in the partial image has been identified in this way, the processor determines, in the above manner, which position the position-coding pattern in the partial image represents, step 43. The position can be indicated as a pair of co-ordinates. The rotation of the partial

image in relation to the information carrier can be determined based on knowledge of the arrangement of symbols in the position-coding pattern. Furthermore, the position of the partial image can be determined more exactly by determining the position of the position-coding pattern on the sensor.

In the next step, step 44, the position-coding pattern is filtered out of the partial image. This is effected by the processor determining, for each dot forming part of the position-coding pattern, the value of the pixels closest to the periphery of the dot. The processor then restores the image by replacing, for each symbol, i.e. dot, all the pixels in the partial image which constitute the dot with the average of the pixel values of the pixels adjacent to the periphery of the dot. Alternatively, the processor can replace sectors in the dot with pixels with the average of the pixel values of the pixels adjacent to the sector arc.

When the position-coding pattern has been filtered out, the partial image is stored, step 45, in a location in the memory which is determined by the position coordinates. In this connection, it may happen that the partial image completely or partially overlaps a previously stored partial image. In that case, the average value of overlapping pixels is calculated and the average value is stored in the location for each overlapping pair of pixels.

The location in the memory where the partial image is stored need not be determined exclusively on the basis of the position co-ordinates. More particularly, the position coordinates can be used for carrying out a rough positioning, whereas a fine positioning is carried out by registering (aligning) the partial image with previously stored partial images by using the overlapping content of the partial images.

When all the partial images have been stored, the memory contains a composite digital image of the area

on the information carrier which has been scanned using the device. This digital image can be incorporated into a fax, a document, an e-mail message, or the like. The image could also be used as an input signal to OCR or ICR software which interprets the text in the image and stores it in character-coded format.

Furthermore, the stored partial images can be shown on the display 20 in order to help the user see the areas on the information carrier which he has not covered. For this purpose, a pixel on the display 20 may correspond to a certain area on the transparent sheet and be turned on as soon as the corresponding area has been covered. As another alternative, the information recorded from the information carrier can be displayed on a screen of a stationary computer to which the partial images are sent successively so that the user can see how the composite image of the information on the information carrier develops.

Alternative embodiments

In the example above, the information and the position-coding pattern are recorded simultaneously with the aid of the electromagnetic radiation from one or more LED.s. As an alternative the pattern and the information can be recorded in an alternating manner such that every second partial image comprises the pattern and every second partial image the information. In this case, the information and the pattern must be recorded by electromagnetic radiation of different wavelengths. This embodiment has the advantage that the position-coding pattern may be placed under the information carrier and thus need not be transparent. Another advantage is that there is no position-coding pattern in the partial images of the information that need to be filtered out.

Furthermore, Fig. 7 shows an embodiment according to which information can be recorded with different resolution. The sheet 70 in Fig. 7 has a large image recording area 71 covered by a position-coding pattern like in Fig.

1 (for ease of illustration, the coding pattern is only showed by some dots), and two small resolution-indicating boxes 72,73, which are also covered by a position-coding pattern. The pattern in the boxes codes specific co-ordinates, which have been dedicated for the indication of different degrees of resolution. When the user wants to record information with a 100 dpi resolution, he puts the recording device in box 71. The device recognises the co-ordinates coded by the pattern in box 71 as indicating a resolution of 100 dpi and then carries out the recording with this resolution.

Fig. 8 shows schematically an alternative embodiment of the device for recording information, where the sensor for recording partial images is accomodated in a first casing 80 and the image-processing means are accomodated in a second casing 81. The first casing can be the same as that shown in Fig. 4 and include substantially the same components. However, the recorded partial images are not processed in the first casing 80 but transferred to the second casing 81, e.g. a stationary personal computer which has image-processing means 82, schematically shown with broken lines, for carrying out the processing of the recorded partial images.

CLAIMS

1. A method of electronic recording of information from an information carrier, characterised by the steps of

placing a position-coding pattern and the information carrier such that one superimposes the other;

imaging the information on the information carrier and the position-coding pattern with the aid of a plurality of partial images; and

using the position-coding pattern for putting together the partial images into a composite image of the imaged information.

2. A method according to claim 1, wherein the step of placing comprises placing a sheet with the position-coding pattern on top of or under the information carrier.

3. A method according to claim 2, wherein the sheet with the position-coding pattern is transparent except for the position-coding pattern and is placed on top of the information carrier.

4. A method according to claim 1, 2 or 3, wherein both the information on the information carrier and the position coding pattern are imaged in every partial image.

5. A method according to any one of claims 1-4, further comprising the step of filtering out the position-coding pattern.

6. A method according to claim 5, wherein the step of filtering out the position-coding pattern comprises replacing pixel values representing the position-coding pattern with pixel values obtained by averaging pixel values representing the information.

7. A method according to claim 5 or 6, wherein the position-coding pattern is made up of symbols and wherein the step of filtering out the position-coding pattern

comprises, for each symbol, averaging the pixel values of pixels adjacent to the periphery of the symbol and replacing pixels in the symbol with said average of the pixel values.

8. A method according to any one of the preceding claims, wherein the step of using the position-coding pattern for putting together the images into a composite image of the information comprises the substeps of determining one position for each partial image of the information on the basis of the position-coding pattern in the same or adjacent partial image and determining where the partial image of the information should be stored in a memory area on the basis of the determined position.

9. A method according to any one of claims 1-4, wherein the step of using the position-coding pattern for putting together the partial images into a composite image of the information comprises the substeps of identifying the position-coding pattern in each partial image; determining, with the aid of the position-coding pattern, a position representing the position of the information imaged in the partial image on the information carrier; filtering out the position-coding pattern from the partial image; and storing the partial image in a location in a memory area which is determined by the position determined with the aid of the position-coding pattern.

10. A method according to claim 8 or 9, further comprising the steps of, if a pixel in the partial image which is to be stored in the memory area overlaps a pixel in a partial image previously stored in the memory area, determining an average value of the pixel values of these overlapping pixels, and replacing the previously stored pixel value with said average value.

11. A method according to any one of the preceding claims, further comprising the steps of imaging the information on the information carrier with a first resolution if a first part of the position-coding pattern

on the sheet is detected, and imaging the information on the information carrier with a second resolution if a second part of the position-coding pattern is detected.

12. A product intended to be used in connection with electronic recording of information from an information carrier, which product comprises at least one sheet-shaped portion (1) provided with a position-coding pattern (3) which extends across the sheet and codes a plurality of positions on the sheet, c h a r a c t e r i s e d in that the sheet-shaped portion (1) is transparent except for the position-coding pattern (3), the sheet-shaped portion being adapted to be placed on top of the information carrier for recording the information from the same.

13. A product according to claim 12, wherein each position of said plurality of positions is coded by a specific part (5a, 5b) of the position-coding pattern, and each such part of the position-coding pattern also contributes to the coding of adjoining positions.

14. A product according to claim 12 or 13, wherein the position-coding pattern is made up of a plurality of symbols (4a, 4b) of at least a first type.

15. A product according to claim 14, wherein the position-coding pattern is made up of a plurality of symbols (4a, 4b) of a first and a second type only.

16. A product according to claim 14 or 15, wherein each position of said plurality of positions is coded with the aid of a plurality of symbols (4a, 4b).

17. A product according to any one of claims 14-16, wherein each of said symbols (4a, 4b) contributes to the coding of more than one of said plurality of positions.

18. A product according to any one of claims 12-17, wherein the position-coding pattern is based on a first string of symbols which contains a first predetermined number of symbols and which has the characteristic that if a second predetermined number of symbols are taken from the first string of symbols, the location of these

symbols in the first string of symbols is unambiguously determined, the first string of symbols being used for determining the position of the partial image in a first dimension on the information carrier.

19. A product according to any one of claims 14-18, wherein the symbols are regular in shape, preferably rotationally symmetrical.

20. A product according to any one of claims 14-19, wherein the symbols are composed of two colours with a contrasting effect.

21. A product according to any one of claims 14-18, wherein each symbol comprises a raster point (5) and at least one marking (6); the raster point is included in a raster which extends across the surface; and the value of each symbol is indicated by the position of said marking in relation to a raster point.

22. A product according to any one of claims 12-21, further comprising a first area with a first part of the position-coding pattern which is dedicated for the recording of the information with a first resolution, and a second area with a second part of the position-coding pattern which is dedicated for the recording of the information with a second resolution.

23. A computer-readable medium, which stores a computer program for recording information, which computer program comprises instructions for bringing a general purpose computer to process a plurality of partial images, which together comprise the information to be recorded and a position-coding pattern, the processing comprising the step of using the position-coding pattern for putting the partial images of the information together into a composite image of the information.

24. The computer-readable medium according to claim 23, wherein the processing also comprises the step of filtering out the position-coding pattern.

25. The computer-readable medium according to claim 24, wherein the step of filtering out the position-coding

pattern comprises replacing pixel values representing the position-coding pattern with pixel values obtained by averaging pixel values representing the information.

26. The computer-readable medium according to claim 24 or 25, wherein the position-coding pattern is made up of symbols and wherein the step of filtering out the position-coding pattern comprises, for each symbol, averaging the pixel values of pixels adjacent to the periphery of the symbol, and replacing pixels in the symbol which hides the information with the average of the pixel values.

27. A device for recording information, comprising at least one sensor (14) for recording partial images of an information carrier and a position-coding pattern (3) which are superimposed the one on the other; image-processing means (16) for processing the partial images recorded by the sensor, which image-processing means are adapted to use the position-coding pattern to determine where at least some of the partial images should be stored in a memory area.

28. The device according to claim 27, wherein the sensor (14) for recording partial images is accomodated in a first casing and the image-processing means for processing the partial images is accomodated in a second casing.

29. A system comprising a product according to any one of claims 12-22 and a device according to claim 27 or 28.

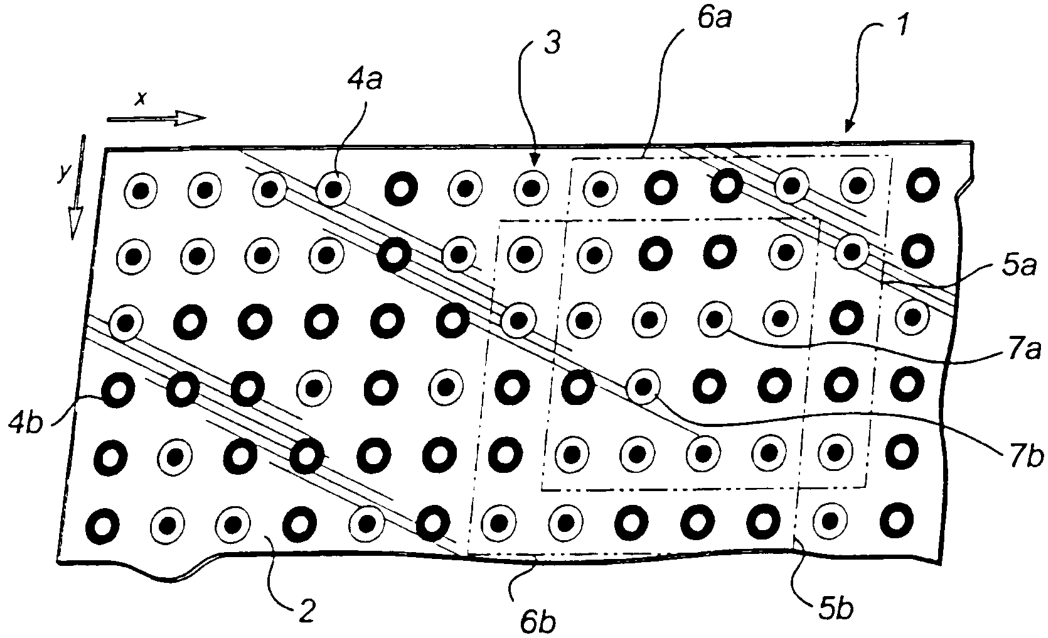

Fig. 1

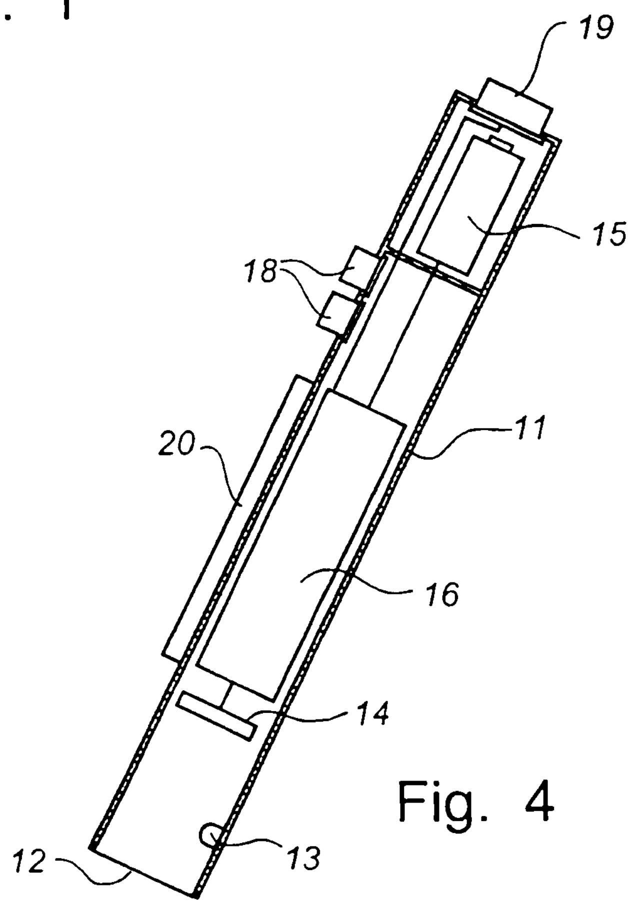

Fig. 4

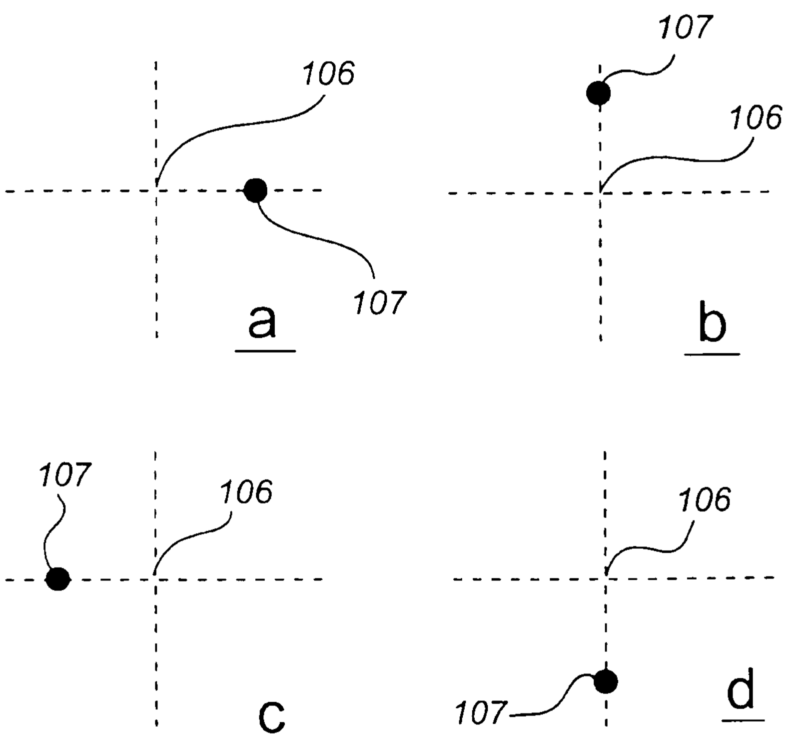

Fig. 2

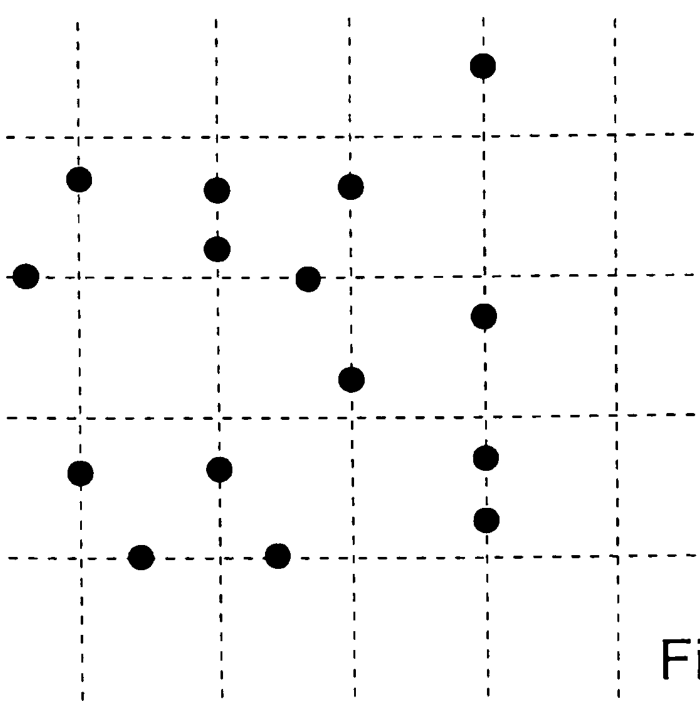

Fig. 3

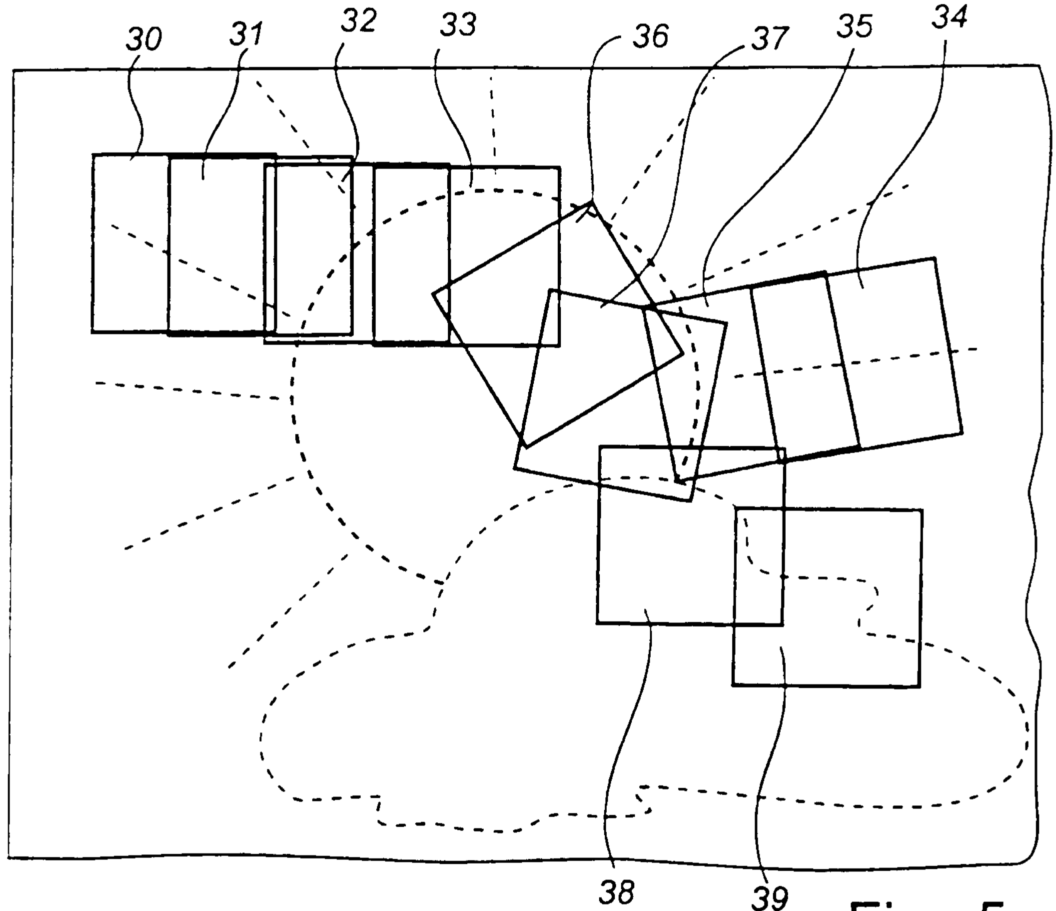
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Fig. 5

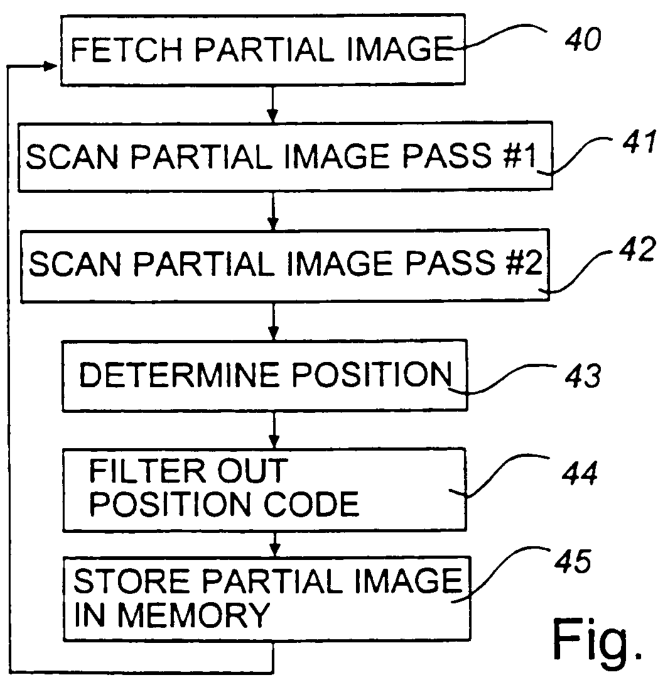
FETCH PARTIAL IMAGE
40
SCAN PARTIAL IMAGE PASS #1
41
SCAN PARTIAL IMAGE PASS #2
42
DETERMINE POSITION
43
FILTER OUT
POSITION CODE
44
STORE PARTIAL IMAGE
IN MEMORY
45

Fig. 6

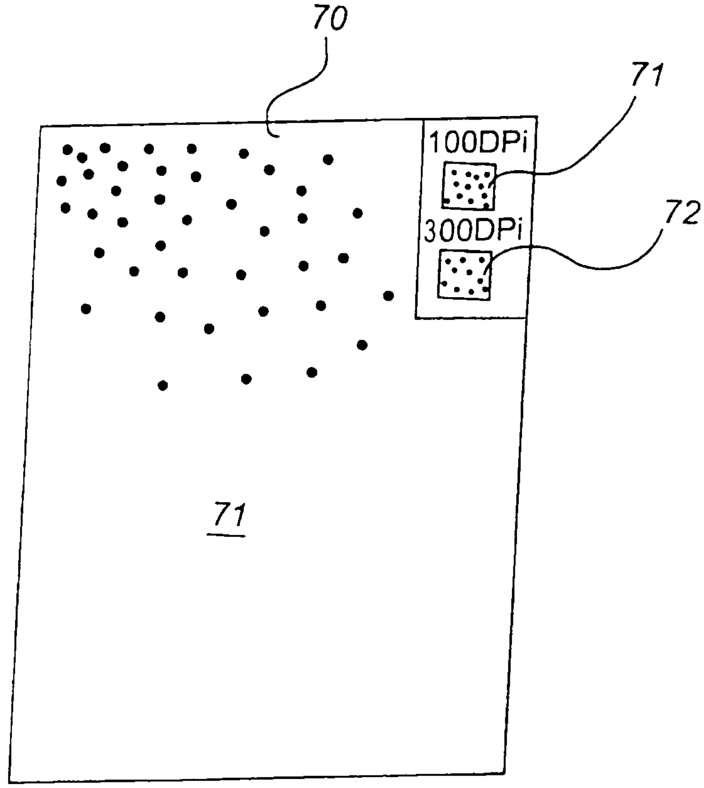

Fig. 7

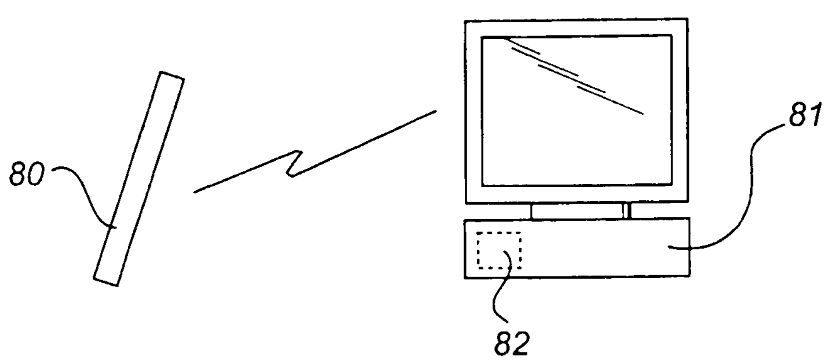

Fig. 8